On the Reproduction of *Epitonium rupicola* Kurtz

(Gastropoda : Epitoniidae)

BY

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(1 Plate; 1 Text figure)

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INTRODUCTION

The Brown-Banded Wentletrap *Epitonium rupicola* (Kurtz, 1860) is a carnivorous marine gastropod that occurs in the western Atlantic from Cape Cod, Massachusetts, to upper Florida, and west to Texas (Clench and Turner, 1951). It is rarely found intertidally but appears to be more common offshore down to a depth of about 50 meters. Although some aspects of its natural history may be inferred from the meager studies on related species, the biology and ecology of *E. rupicola* remain essentially unknown. Robertson (1963) described the feeding habits of specimens collected in Delaware Bay, New Jersey, and he also reviewed the literature on feeding in other wentletraps. It is the purpose of this paper to describe the egg capsules of *E. rupicola* and to present some observations on its early development.

OBSERVATIONS

Three snails, each in the process of producing strings of egg capsules, were collected on three separate occasions (1960, 1962, 1963) from the muddy-sand flats of Delaware Bay, New Jersey (Table 1; Figure *1*). The location was the same in each case, namely, in the extensive intertidal area south of Pierces Point and approximately 16 km north of Cape May Point (39°04.5′ N; 74°54.9′ W). They were collected by hand during low tide in shallow sloughs that run parallel to the shore about 75-100 m below the mean high tide mark. Water temperatures at high tide on each date were 25.5, 23.2 and 24.6° C, respectively; corresponding salinities were 20.2, 17.8 and 21.4 ‰. The flats were searched periodically throughout the spring, summer and fall of these and other years, but additional snails or egg capsules were not recovered. In 1968, another

Table 1

The number of egg capsules produced by *Epitonium rupicola* in the field and in the laboratory

Snail number	Date of collection	Location	Shell length (mm)	Number of egg capsules	
				Field	Laboratory
1	22-7-60	Delaware Bay, New Jersey	13.7	133	[1]
2	21-6-62	Delaware Bay, New Jersey	17.2	76	20
3	19-6-63	Delaware Bay, New Jersey	16.0	123	66
4	3-7-68	Mouth of York River, Virginia	19.3	[2]	54
5	17-6-70	Gloucester Point, Virginia	[3]	126	—

[1]Snail and capsules preserved on day of collection.
[2]Snail collected in a dredge; no capsules.
[3]Snail not collected.

Epitonium was dredged from several meters of water near the mouth of the York River, Virginia (37°14.7'N; 76°25.0'W). A complete string of egg capsules, without the snail, was obtained several meters offshore in a bed of eelgrass (*Zostera*) at Gloucester Point, Virginia (York River) (37°14.7'N; 76°30.1'W), in 1970. High water temperature on that date was 23.1°C and the salinity was approximately 19 ‰. All snails and their capsules were brought to the laboratory, where they were placed in fingerbowls and observed. The snails will be referred to in the following text as numbers 1-5 (Table 1).

Snails in the process of forming egg capsules remain buried in the bottom so that the only evidence of their presence is the string of capsules on the surface. The string is extremely difficult to detect because each capsule is covered with silt and sand grains and closely resembles the substratum (Fig. 2). Upon casual observation, the string of capsules resembles a piece of debris or a branching bryozoan colony. Each string of capsules from the Delaware Bay snails was still attached to the snail, which indicates that the snails were still in the process of producing capsules, or if they had completed the process (possibly nos. 1 and 3, Table 1), the string is not released until some later time.

The numbers of egg capsules in strings produced by snails 1, 3 and 5 in the field may represent the normal range for completed strings. The string collected in 1970 must have been complete because larvae were emerging from all but two of the 126 capsules at the time of the collection.

After producing 123 capsules in the field, snail 3 deposited an additional string of 66 capsules in the laboratory approximately one month after it was collected. During this interval it was maintained under poor conditions (standing seawater, infrequent water change and no food). Hence, its 189 capsules may be only a minimum estimate of the reproductive potential of *Epitonium rupicola*. That this snail produced egg capsules in the laboratory suggests that under natural conditions more than one string of capsules may be produced during the reproductive season. Although the minimum length of time necessary for a snail to produce a complete string of capsules is not known with any certainty, I did observe that the 54 capsules produced in the laboratory by snail 4 were laid within a 24-hour period.

The snail secretes a tough elastic string to which the capsules are attached. It is 0.06 to 0.20 mm in diameter, being thicker in the region of the capsules and tapering at the free ends. Neither sand grains nor silt are attached to the translucent string as it evidently lacks the sticky outer coating found on the capsules themselves. Apparently a short length of the string is secreted, and then the snail cements each capsule around the string as it continues to be secreted. The proximal end of the completed string is also devoid of capsules; apparently the string continues to be secreted after the formation of capsules is discontinued. Capsules are linearly arranged on the string in an alternate fashion so that they project from the string at angles of 90 - 130° or more from the next one on the opposite side. In some cases, there are series of three capsules, two of which project in the previous manner with another in between which may be 45° - 70° from the other two. This pattern is repeated along the string. It appears, therefore, that the capsules alternate in an arc of usually less than 180°, but the string becomes twisted to give an overall spiraled effect. The proximal end of each capsule touches the next. Snails, 1, 2, 3, and 5 produced strings of capsules that were approximately 50, 25, 50 and 56 mm in length, respectively (excluding the free ends of the strings). The length of the free ends of a string may total another 50 mm.

The capsules are cylindrical in shape, and round to oval in cross section (Figure 2). Their distal ends are rounded or somewhat flattened. The latter is an effect produced in some capsules by the coating of sand because capsules produced in clean dishes are all rounded distally. The proximal end of each capsule is drawn out into a nipple which completely surrounds the string (Figure 3). Each capsule does not fuse completely with the string because the latter can be pulled through the eye of the nipple. A few capsules on each end of the string are often somewhat stunted or misshapen. This phenomenon is usually seen in

Explanation of Figures 1, 2, 4, and 5

Figure 1: *Epitonium rupicola* no. 2 collected 21 June, 1962, in Delaware Bay, New Jersey. Scale = 5.0 mm

Figure 2: String of 76 egg capsules produced in the field by *Epitonium rupicola* no. 2; note the general arrangement of the capsules on one of the free ends of the string. Scale = 5.0 mm

Figure 4: Veligers of *Epitonium rupicola* within a flattened capsule (produced in the laboratory) that are about ready to hatch. Scale = 0.2 mm

Figure 5: Veliger of *Epitonium rupicola* within an egg capsule (same as Figure 4) at high power magnification to show the conspicuous dark purple gland on the right side; one of the statocysts may also be seen. Scale = 0.05 mm

Figure 1

Figure 2

Figure 4

Figure 5

the strings of capsules produced by other gastropods (*e.g., Busycon).*

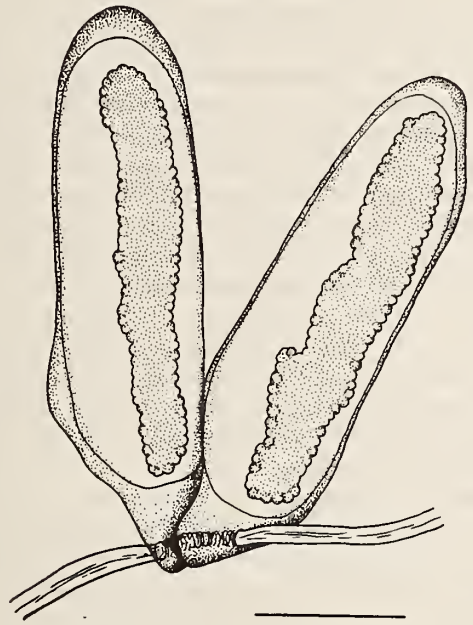

Figure 3

Two egg capsules from a string of 54 capsules produced in the laboratory by *Epitonium rupicola* no. 4; the capsules are less than 24 hours old and the embryos at this stage tend to adhere to one another. Scale = 1.0 mm

The mean length of the capsules produced by individual snails appears to vary directly with the size of the snail, but the shape of the capsules is consistent. I measured ten capsules from each of three preserved strings produced in the field. Capsules from the smallest snail (no. 1) had a mean total length of 2.72 mm (range 2.22 - 2.88 mm). Capsules of snail 2 were 3.28 mm (3.19 - 3.45 mm) in length, and those from no. 3 were 3.48 mm (range 3.11 - 3.70 mm). Two capsules from no. 5, with unhatched veligers, were both 3.21 mm long. The mean diameter (width) of ten capsules from no. 2 was 1.09 mm (range 0.97 - 1.14 mm); the maximum diameters of the two capsules from no. 5 were 1.03 and 1.08 mm. In summary, the capsules are approximately 2.5 - 3.5 mm in total length and about one-third as wide. Capsules produced by snails in clean dishes of seawater are understandably shorter and narrower because they lack sand grains. One such capsule produced by snail 2 was 2.75 by 0.95 mm. Capsules deposited under the same conditions by the largest snail (no. 4) were all approximately 3.7 mm in total length. If sand grains were attached, these would have exceeded the length of all others.

The basic construction of the capsules can be perceived only in those produced by snails in clean dishes devoid of particulate matter. The capsules are cylindrical with rounded ends, and completely transparent. The outer layer is especially thickened distally and near the base (Figure 3). It is initially very adhesive but becomes less so as it hardens. A thin membrane encloses the inner egg-bearing part of the capsule. It appears unlikely that snails, under natural conditions, mechanically manipulate sand grains and cement them to the capsules. Furthermore, it is doubtful that sand grains of uniform sizes are in any way selected by the snails as has been suggested for other species of Epitoniidae (Fretter & Graham, 1962: 402). It is most likely that the capsules are fortuitously covered with whatever particulate material occurs in the substratum housing the snail. Capsules of *Epitonium rupicola* were covered with sand grains of various sizes, texture and mineralogy. Where there are only a comparatively few sand grains on an individual capsule, the rest of the capsule is covered with silt.

The fertilized eggs are in a viscous, albuminous fluid, usually clumped in the recently formed capsule, and become separated as development proceeds. The numbers of eggs in three randomly selected capsules from snail 4, were 339, 400 and 554 (mean 431). A snail producing 125 capsules in one egg-string with an average of 400 eggs per capsule, has the potential of producing 50 000 veligers.

Periodic observations were made on the development and hatching of the veliger larvae, but no attempt was made to bring the larvae to metamorphosis. Capsules from snail 2, collected on 21 June 1962, were kept in a 11.5 cm diameter fingerbowl, and the water was changed daily (salinity approximately 25‰; water temperature 20 - 22° C). Four days later there were motile shelled veligers in the capsules, and large numbers emerged on 29 June (Figure *4*). Each capsule had an opening at the distal end, and on some an irregular flap of the capsular wall was attached near the opening. The remainder of the veligers hatched on the following day. Three randomly selected capsules preserved before hatching contained 247, 376 and 549 veligers (mean 391). Two capsules from snail 5 contained 335 and 358 veligers. Twenty recently hatched, preserved veligers (from snail 2), measured with a calibrated ocular micrometer, had a mean shell length of 0.160 mm (range 0.152 - 0.163 mm).